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ABSTRACT

Discussed are the multiple impacts of microelectronics on society. Included are discussions of the problem of predicting effects, difficulty of exploiting new technology, manpower consequences, and needs within the United Kingdom relating to microprocessors. (RE)

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THE EFFECTS OF MICROPROCESSORS ON INDUSTRY SOCIETY AND EMPLOYMENT

A Meeting of the Frontier Group

on

Strategies for Change in a Technological Society

held at the

University of Bath

on

Tuesday 13th March 1979

Report by N.D.C. Harris

Director, Science and Technology Education Centre.

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1. INTRODUCTION

This is a report of one of the termly meetings held by the Frontier Group on Strategies for Change in a Technological Society. The purpose of the Frontier Group and its membership are attached as an appendix. The group invites industrialists, trade union officials, teachers and other participants when outside speakers are invited. If you would be interested in further information about these meetings of the Frontier Group please tick on the appropriate boxes on the back page and return the sheet to the address on that sheet.

The Frontier Group relates to a range of organisations functioning in the West of England (in particular Avon, Gloucestershire, Somerset and Wiltshire). The organisations include some of the national network of SATRO's (Science and Technology Regional Organisations), Avon Science and Technology Centre, Science and Technology Regional Organisation (Wiltshire), Science and Technology Education Centre (University of Bath), Science, Technology and Craft Centre (Gloucestershire). The SATRO's enable links between industry, commerce and the various levels of education (in particular schools) as the recipients.

The meeting reported is the third in a series during 1979. An earlier meeting was addressed by Professor Gosling, School of Electrical Engineering, University of Bath, using the title "The Kingdom of Sand". Professor Gosling's lecture is available from the Centre at Bath in printed form (listed on the last sheet of this publication), and also in video cassette form.

The meeting on 13th March was addressed by two speakers:

Mr. E.J.D. Warne, Department of Industry
Mr. J. Sleigh, Department of Employment

The report is from an observers point of view and does not imply that the views reported are those of the speakers or their departments.

2. DEVELOPING TECHNOLOGY AND TECHNOLOGICAL CHANGE

Four main areas will be considered under this heading:

2. (cont.)

The problems of predicting effects.
The difficulties of exploiting new technology.
The absence of inevitability.
The need for common sense.

The problems of predicting effects

The problems of predicting effects are not new. Examples of some false predictions at the end of the last century included: "the gas industry has nothing to fear from the electric lamp", "the telephone will never take on in the U.K. because the distances are much shorter than in the U.S.A." In recent years it was predicted that computers would bring about mass unemployment. People who give such predictions are usually experts in their own field.

The prediction of growth industries is even more difficult. In the present economic climate some columnists would say that the chances of any growth are very slim indeed. The important question about growth is not "what?" but "when?" In any case if there are growing markets for a product, there is no guarantee that industry in the U.K. can be successful. An obvious post war example is the motor industry.

When predictions are related to microprocessors, or in more general terms microelectronics, the same problems arise. Another facet of the predictions is the effect on employment. In industry and services where processes and procedures can be carried out more efficiently, more reliably and cheaper with machines there may be losses in employment. Examples of industries with this problem could be garages using electronic diagnoses, the printing industry using word processors, warehousing using automated procedures. In other services, such as banking, microelectronics may enable extra services to be offered without loss in employment.

The difficulties of exploiting new technology

From a national point of view it is important to exploit a new technology such that it gives an edge over foreign competitors. What new industries will occur? The gradual changes are not the only features, sudden changes often have

more impact. Two examples of sudden changes are the energy crisis, the development of N. Sea oil. Who could have foreseen before the discovery of N. Sea oil that a resurgence of some heavy engineering industries would occur.

As a nation our main problem is economic performance. Over recent years our share of world exports has steadily fallen to less than 10%. Our GNP will soon fall below that of Italy. Industrial performance will not be determined by microprocessors or microelectronics. However these devices do give an opportunity to change the trend of de-industrialisation and loss of jobs.

The absence of inevitability

The inevitability of the impact of new technology is not certain. The UK has had a long recession since the oil crisis. Microprocessors give us the opportunity to exploit the competitiveness of UK products. As a nation we have the advantage of software skills and we are already a centre of micro-technology. The dangers are in a maintenance of slowness to adapt. The country has suffered for most of this century from an "arthritis" for change

The need for common sense

The effects of microprocessors and microelectronics need to be considered cooperatively by government, management and trades unions. Earlier we saw how wrong experts can sometimes be. Some highly coloured predictions have been produced (e.g. that in 15-20 years some 2% of the population will produce all that we need,)but such estimates have no foundation in reality and betray considerably naivety. It is as well to remember that ten years ago predictions were made about computers acting as translating machines and intelligent robots. In spite of the rapid advance in computers, which are now faster and more reliable, predictions have not been met.

When considering the effects of new technology a very important factor is the time for a new development to make the existing technology obsolete. An example is the laser which was developed in 1959. The laser has many potentials, but it is only now that major applications are beginning to occur: a twenty year development. The time factor is also dependent on capital being available to enable manufacture at an economic cost. Return on investment in developed countries is low - about 2½% in manufacturing industries.

Examination of prospects for the long term can give us broad ideas about possible trends, but there is no precision. Equally nothing is inevitable about our economic performance - it all depends on ourselves.

3. THE MANPOWER CONSEQUENCES

A message written on a blackboard in an Underground station may help to keep our perspective. "Automatic ticket machines not working due to staff shortage".

As has been suggested the estimates of the effects of microelectronics vary from 90% unemployment to an increase in employment. The two ends of the spectrum can be roughly described as follows:

(a) the technological determinists who assume: a static range of output and products, levels of unemployment are implicit in the new technology (ignoring spin-off effects), anything technically feasible is bound to happen (an example where this has not occurred is tele-conferences because people prefer the social contacts)

(b) the optimists who assume: the traditional macro-economics model giving wealth creation leading to new employment opportunities, a behavioural argument that human choice will, in fact, impose restraints upon the rate of diffusion of new technology.

Inevitably, government departments do not give spectacular predictions, so that sometimes one department is accused of doing a whitewash job for another department.

The argument that follows has developed from a case study approach. Two effects have been used as a basis: the effects of the new technology already in use, and the expectations of the use of the new technology. The case studies have been based in industry, commerce, and services. The time scale is 5 - 10 years.

The basis for the analysis is to look separately at product and process effects. On products, spectacular examples of job loss can be found in the electronics industries. Digital telecommunications manufacture has caused 30,000 jobs to be shed with an ultimate possibility of subsisting on 10% of the original

labour force. Cash registers and colour TV are two other manufacturing industries where integrated circuits have produced similar effects, because of the considerable reduction in manual circuit construction. However, the electronics industry is also the industry with the most potential for new products. Predictions are that a 15% per annum growth in the electronics industry would give stable employment. In Japan and USA there have been new employment gains in this industry.

What about other industries? Taking the motor car industry as an example, some electronic components will be used, but the car will remain as an essentially mechanical device. Driver navigation systems are quite feasible, would represent a product addition, and would, therefore, generate new jobs. However, if car wiring is developed into a one wire system, with micro-electronic feeders to individual components, this would cause a loss in jobs on assembly. In other words there are ups and downs.

The vital keys are the capital goods industries. New production lines and new warehouses etc. are necessary if we are to maintain our share in the industrial future of the world. There are no signs of massive investment in these industries in the next 5 - 10 years, but when investment is put into these areas jobs will be created if most of the materials and products are to be purchased from UK sources. A major problem will occur if the materials and products come from outside the UK.

In all manufacturing industries computing techniques will be involved in more production and processes. Let us look at these under three headings: batch and mass production and the process industries.

The process industries are highly capital intensive, which has been a continuing trend. An example is that a present plant costing £60m is operated by 50 men on each shift. With microprocessors this may drop to 46 on each shift. The quality control effect could be considerable and less breakdowns will occur.

In batch production there is considerable scope for computing. It will have an impact in stores, inventories and work scheduling, giving a reduction in work in progress, better delivery, lower inventory etc. The significant impact will occur here in 5 - 10 years. Initially there may be some reduction in labour, but in many cases the employment may stabilise and recover as a result of increased output.

For mass production the impact will be in warehousing, stock control and in computer control of production. The impact of robotics in the next 5 - 10 years will be limited because devices at present are only suitable for statically held components.

It is worth remembering in all cases that the sensors (the measuring and observing devices) and actuators (the action devices) are expensive to produce. Microprocessors by themselves have nothing to offer, it is in association with other peripheral equipment that they become effective.

The process will be one of evolution and not revolution.

DISCUSSION ARISING FROM THE ADDRESSES

1. Education has not been mentioned

The requirement from education is more flexible minds, more ability to respond to change and a willingness to contemplate more training in the future.

2. How does UK compare with Germany and Japan on government support for microprocessors ?

The UK government has been slower in supporting the application of microprocessors than the governments of West Germany or Japan, but the scale of support now seems broadly comparable (although the Japanese system is difficult to understand).

3. Microprocessors are only one example of the investment problem, it is not too complacent to say that there is no inevitability in the automation features

The UK is already behind our competitors on automation. Microelectronics will need electro-mechanical devices. The problem is that the likely unemployment from lack of investment will actually be blamed on the introduction of microprocessors. In fact, the use of microprocessors gives us an opportunity to recover some of the lost ground rather than the opposite.

4. Taking the inevitability theme, has any action been taken by groups in planning for the effects (eg Secretaries) ?

The decline to date in the number of typists is probably more due to female consciousness: typing is an area to avoid because it is traditionally female. The introduction of work processors is at present covering the shortage rather than producing unemployment.

5. If microprocessors are such a non-event, as has been suggested today, how can the fears on employment be allayed?

It is not a non-event! Microprocessors are a very important technological development. The prime minister has taken a particular interest in a variety of aspects including the applications of microelectronics.

The changes are not as fast and dramatic as some people suggest, but there is a degree of urgency.

At national level there is a considerable trade union awareness and a sensible attitude to technology, both the unions and management realise the urgency of making British industry more competitive.

Moderation never makes the headlines as effectively as extreme points of view.

6. The old craftsmen are gradually disappearing. There is a need for new technology incorporating microprocessors to be able to 'feel' or 'smell' whether a product is right.

7. There is a need for planning. What training and expertise are needed from those leaving secondary school and further education?

There is a need for people who know what they are doing. At first it was thought that cross disciplinary skills were needed, but it is not feasible.

The main decisions will be made by the Industrial Training Boards - they are all identifying the skill requirements. A similar study is taking place on the non - ITB side.

The Polytechnics are running short and long courses in microelectronics: at present these are mainly taken up by people from the electronics industry.

8. What liaison is there between government departments (eg DES, Department of Industry, Department of Employment)? There appears to be more going on at the grass roots rather than in Whitehall. To what extent is legislation producing employment problems?

There is a close liaison between departments. The problem seems to be that the more one sees of the British educational system the more one is drawn to the conclusion that no one is responsible. The DES say that LEA has autonomy. The LEA says the headmaster has autonomy. The headmaster says the individual teacher has autonomy.

The legislation part of the question: the evidence available from surveys suggests no effect on a large scale. The legislation has brought us into line with the rest of the EEC. (A short but heated discussion followed).

9. What are the needs for re-training?

The information is still being collected. It appears that software skills are a priority area.

STRATEGIES FOR CHANGE IN A TECHNOLOGICAL SOCIETY — FRONTIER GROUP

Name .....

Organisation .....

Address .....

.....

I would like further information about the items listed below:

Frontier Group : Strategies for Change in a Technological Society ☐

Meetings organised by the Frontier Group ☐

Conference : The Educational Implications of Microprocessors and Microelectronics ☐

Publications

Strategies for Change in a Technological Society (£1) ☐

Microprocessors, Society and Education (W Gosling) (£1) ☐

The activities of the following SATRO's :

Avon Science and Technology Centre ☐

Science and Technology Education Centre, University of Bath ☐

Science Technology and Craft Centre, Gloucester ☐

Science and Technology Regional Organisation (Wiltshire) ☐

My organisation would be willing to assist with the finance of activities organised by the Frontier Group — Yes/No/Require further discussion

UNIVERSITY OF BATH

SCIENCE AND TECHNOLOGY EDUCATION CENTRE

FRONTIER GROUP

1. The theme of the Frontier Group is
   Strategies for Change in a Technological Society

2. The Frontier Group will develop ideas for Strategies for Change.

3. The membership of the Frontier Group is made up of persons from commerce, churches, education, government departments, industry and trade unions. The membership is not fixed and the Frontier Group welcomes anyone who is interested in its activities and who is prepared to attend the meetings.

4. The Frontier Group will meet three times each year with an initial presentation of ideas by an individual or a group of people. Persons outside the Frontier Group will be invited to this presentation. After a refreshment interval the Frontier Group will meet to consider the implications and what action should be taken if any.

5. The Frontier Group is associated with the University of Bath Science and Technology Education Centre. The Director of the Centre is the secretary and convener of the Frontier Group.

6. The Frontier Group will initiate a Conference theme each year. The Conference organising committee will be made up from a group including some members of the Frontier Group. The Conference organising committee will continue to disseminate the ideas of the Conference in the region (primarily Avon, Gloucestershire, Somerset and Wiltshire) through further activities particularly involving education, industry, commerce and government departments. The activities will last for three to five years including evaluation.

7. Further details are available in a paper:
   "Proposals for the Functioning of the Frontier Group"

FRONTIER GROUP MEMBERS

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